Remarks:

Please reconsider the application in view of the foregoing amendments and the following remarks.

1. Telephone Interview

The Applicant would like to thank the Examiner for courtesies extended in a telephone interview on February 23, 2007. Although agreement was not reached with respect to the claims, the Applicant understands that the Examiner will consider amendment to the claims in the following subject areas.

a. determining an amount of at least one body constituent from the NMR signals

The Applicant argued in the telephone interview that the phrase "determining an amount" was clearly defined in the specification as meaning determining a mass of or determining a volume of one identified substance. It is the Office's position that such definition is not imported into the claim and that the term is construed according to its broadest reasonable meaning in evaluating the patentability of the claim over the prior art. The Applicant will present suitable amendment in certain claims to limit the analysis from the NMR signals to the intended scope of what has been invented.

b. inducing NMR signals along an axial segment of the body

The Applicant will amend the claims so that the inducing of NMR signals is distinct from any known imaging device. In particular, the NMR signals are induced by a particular arrangement of static and gradient magnetic fields. In the method claims as amended, the combined static and gradient magnetic fields have a known amplitude distribution along a selected direction, and are homogeneous in a direction transverse to the selected direction. RF magnetic fields are excited in an axial segment along the selected direction within the combined static and gradient magnetic fields. Apparatus claims have been amended to include magnets and/or means for generating gradient fields that cause the claimed combined magnetic field amplitude distribution.

c. possible statutory subject matter rejections

The Applicant very much appreciates the Examiner calling to attention that method claims 1, 9 and 28 may not have recited statutory subject matter according to recent guidelines instituted by the Office. In particular, the Applicant has amended the method claims to recite that a determined mass is either stored or displayed so as to invoke the tangible, useful result guideline for statutory subject matter in computer implemented methods.

2. Status of the Claims

Claims 1-11, 13-16, 18-20, 22-29 and 31-37 are pending in the application. Claims 1, 7, 9, 20 and 28 are independent. Claims 1-11, 13-15, 20, 22, 24, 27-29 and 31-37 stand rejected as anticipated by Van Yperen (U.S. Patent No. 5,402,787). Claims 16 and 23 stand rejected as obvious over Van Yperen in view of Crowley et al. (U.S. Patent No. 5,517,118). Claims 18 and 25 stand rejected as obvious over Van Yperen in view of Mancuso et al. (U.S. Patent No. 4,784,146). Claims 19 and 26 stand rejected as obvious over Van Yperen in view of Ochi et al. (U.S. Patent Application Publication No. 2003/0069497 A1).

3. Claim rejections - 35 U.S.C. § 102(b)

Independent claims 1, 7, 9, 20 and 28 stand rejected as anticipated by Van Yperen. To the extent the rejection may apply to the claims as amended, the Applicant respectfully traverses the rejection for the following reasons.

As a preliminary matter, claim 1 cannot be anticipated by Van Yperen because each and every element of the claim is not shown in Van Yperen. Claim 1 recites as the very first element, "determining a size and a position of the body portion by imaging a nuclear magnetic resonance parameter of a body in at least one dimension." The image is used to determine size and position of the body portion for which quantitative analysis is to be performed. The determined body part is then subjected to nuclear magnetic resonance signal generation and detection to determine a mass of at least one constituent in the body part. Van Yperen shows imaging the body pixel by pixel. There is no subsequent reevaluation of an identified body part by nuclear magnetic resonance analysis after an image is generated.

The Applicant respectfully points out that the penultimate element of claims 1, 7, 9, 20 and 28 has been amended to recite determining a mass of at least one constituent from the magnetic resonance signals, and apparatus include a means for determining a mass of at least one constituent from the magnetic resonance signals. The Applicant believes that Van Yperen does not disclose determining mass of a body constituent from the NMR signals.

An explanation of what is different about conventional NMR imaging and the constituent mass determination as claimed by the Applicant follows.

In the imaging device shown in Van Yperen, as is also the case for all NMR imaging devices, for each image element ("pixel"), a value related to the total or maximum NMR signal amplitude is generated. The Applicant does not dispute that the value determined for each pixel is related to the density of the nuclei that undergo nuclear magnetic excitation present in each pixel, as the Examiner stated in the Office Action. However, determining density of nuclei in an image pixel is most assuredly not the same thing as determining a mass of a body constituent. The Applicant gives examples in paragraph [0056] of the specification of determining such quantities:

> In the present embodiment, the localized NMR measurements can be CPMG sequences for a relatively large number of spin echoes, such that composition analysis may be performed by multicomponent exponential decay analysis such as will provide mass fractions of several components each having unique transverse and/or longitudinal nuclear magnetic relaxation times. In the present embodiment, body portion composition analysis may include determining fat tissue, lean tissue and water fractions of the body portion.

As used by the Applicant, the term "determining a mass of at least one constitutent" clearly means determining a mass or volume or fractional mass or volume of an identifiable substance. The Applicant has reviewed the cited portion of Van Yperen (col. 4, lines 29-36) cited by the Examiner and the Applicant agrees that Van Yperen states that "information about the density of a certain type of nuclei…..and the substances in which they occur." That is not the same thing as "determining a mass of at least one constituent." Van Yperen therefore does not explicitly disclose "determining a mass of at least one constitutent." In order for the disputed element to be

impliedly disclosed by Van Yperen, a person of ordinary skill in the art would have to understand that the disputed element is necessarily present in the disclosed apparatus or method. It is the Applicant's assertion that such is not the case.

In NMR imaging, an image is typically displayed as one or more two-dimensional gray scale transparencies, video displays or other representation of the signals generated by the imaging apparatus. As is well known in the art, such visual representation includes a gray scale representation of the signal amplitude from each pixel. The image reviewer makes inferences about the type of substance in portions of the image by their visual appearance, such appearance including elements of structure and gray scale brightness or darkness. Such inferences can also be made by machine, but in the end there is no explicit identification of a substance by quantitative NMR analysis, there is only inference from signal amplitude. In quantitative analysis, as the Applicant's disclosure clearly explains, the NMR signals originating in the volume of the body being investigated are subjected to analysis such as multicomponent exponential decay analysis, to determine, quantitatively, and amount of one or more substances disposed within the NMR investigated volume.

More importantly, as amended claim 1 recites that a static magnetic field and a gradient magnetic field are induced in at least the body portion. A radio frequency magnetic field is induced in at least the body portion at a frequency selected to excite nuclear magnetic resonance phenomena. Nuclear magnetic resonance signals are detected from at least the body portion. The static magnetic field and the gradient magnetic field have amplitudes selected such that the nuclear magnetic resonance phenomena are induced and detected substantially entirely within the body part. As the claim has been amended, the combined static and gradient magnetic fields are substantially homogeneous along a direction transverse to the gradient magnetic field. In imaging devices such as shown in Van Yperen, the static magnetic field has superimposed thereon gradient magnetic fields in three orthogonal directions. Because of the superimposed gradient magnetic fields, in imaging devices the combined static and gradient fields cannot be homogeneous in a direction transverse to the gradient magnetic field.

The Applicant's claimed invention is quite different from imaging devices such as shown in Van Yperen in that in the Applicant's claimed invention, the entire axial segment itself constitutes an individual voxel, and such voxel may encompass the entire volume of the body part being analyzed because the nuclear magnetization will be substantially uniform in the entire cross section transverse to the gradient magnetic field. Such nuclear magnetization is a necessary result of the claimed transversely homogeneous static magnetic field. The mass of the at least one constituent is determined quantitatively from the signals measured entirely within the individual voxel. Such determination of mass is simply not disclosed in the prior art. The Applicant has outlined numerous possible advantages of using such measurement technique, including that by measuring NMR signals over a sufficiently large volume, it is possible to have substantial signal to noise ratio using relatively low static magnetic field amplitudes and correspondingly low RF magnetic field amplitudes. Just as importantly, by analyzing amounts of one or more constituents in each of a relatively limited number of image voxels (which in some implementations may be as few as one over the entire body) a body or body part composition analysis may be performed in much shorter time than by conventional image integration. Additionally, because the mass is determined only from the NMR signals in all of each body part or whole body, it is not necessary to determine the whole body volume to determine fractional constituent amounts, as with prior art imaging techniques. Such is not possible with prior art imaging techniques, which can only provide information about volume fraction of constituents inferred from image amplitudes in each voxel. Finally, the Applicant's claimed invention can determine the amount of more than one constituent in each body portion (voxel) or body from the NMR signals measured in that portion or body. Such multiple component amount determination in a body portion or entire body is not disclosed or implied in any of the prior art of record.

To summarize, the prior art of record does not show determining a mass of at least one constituent in a body part using NMR signals from that body part. Accordingly, claim 1 cannot be anticipated by Van Yperen.

Claims 7, 9 20 and 28 all include either corresponding method elements or corresponding means for performing the corresponding method element explained above with reference to claim 1. For at least the same reasons advanced with respect to claim 1, Van Yperen cannot anticipate any of claims 7, 9, 20 and 28.

Claims 2-6, 8, 10-19, 21-27, and 29-37 ultimately depend from claims 1, 7, 9, 20 and 28, respectively, and are believed to be patentable for at least the same reasons advanced with respect to the foregoing independent claims.

New claims 38 and 39 depend from method claims 1 and 28, respectively and recite that the mass is determine without sedating, anesthetizing and restricting movement of a human patient. As explained in the Background section of the application, use of MRI devices for composition analysis requires at least one of the foregoing because of the spatial distribution of nuclear magnetization produced by MRI devices. In the Applicant's invention, the lateral homogeneity of nuclear magnetization enables performing the method as claimed. Such is inferred from the Background section of this application and set forth in paragraph [0072] of the specification.

This Reply is believed to be fully responsive to each and every ground of rejection cited in the Office Action of January 29, 2007, and the Applicant respectfully requests early favorable action on this application.

Respectfully submitted,

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